

# BC69PAS series

20 V, 2 A PNP medium power transistors

Rev. 1 — 19 June 2015

Product data sheet

## 1. Product profile

### 1.1 General description

PNP medium power transistors in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

NPN complement: BC68PAS series

### 1.2 Features and benefits

- High collector current capability  
 $I_C$  and  $I_{CM}$
- Reduced Printed-Circuit Board (PCB) area requirements
- Exposed heat sink for excellent thermal and electrical conductivity
- AEC-Q101 qualified
- Three current gain selections
- Leadless very small SMD plastic package with medium power capability
- Suitable for Automatic Optical Inspection (AOI) of solder joint

### 1.3 Applications

- Linear voltage regulators
- Battery driven devices
- MOSFET drivers
- High-side switches
- Power management
- Amplifiers

### 1.4 Quick reference data

**Table 1. Quick reference data**

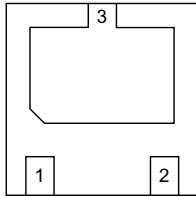
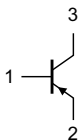
$T_{amb} = 25\text{ °C}$  unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-20	V
$I_C$	collector current		-	-	-2	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	-3	A
$h_{FE}$	DC current gain	$V_{CE} = -1\text{ V}$ ; $I_C = -500\text{ mA}$	[1]	85	-	375
	$h_{FE}$ selection -16	$V_{CE} = -1\text{ V}$ ; $I_C = -500\text{ mA}$	[1]	100	-	250
	$h_{FE}$ selection -25	$V_{CE} = -1\text{ V}$ ; $I_C = -500\text{ mA}$	[1]	160	-	375

[1] Pulse test:  $t_p \leq 300\text{ ms}$ ;  $\delta \leq 0.02$ .

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base	 <p>Transparent top view</p>	 <p>sym013</p>
2	emitter		
3	collector		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BC69PAS	DFN2020D-3	plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 × 2 × 0.65 mm.	SOT1061D
BC69-16PAS			
BC69-25PAS			

## 4. Marking

Table 4. Marking codes

Type number	Marking code
BC69PAS	C1
BC69-16PAS	C2
BC69-25PAS	C3

## 5. Limiting values

Table 5. Limiting values

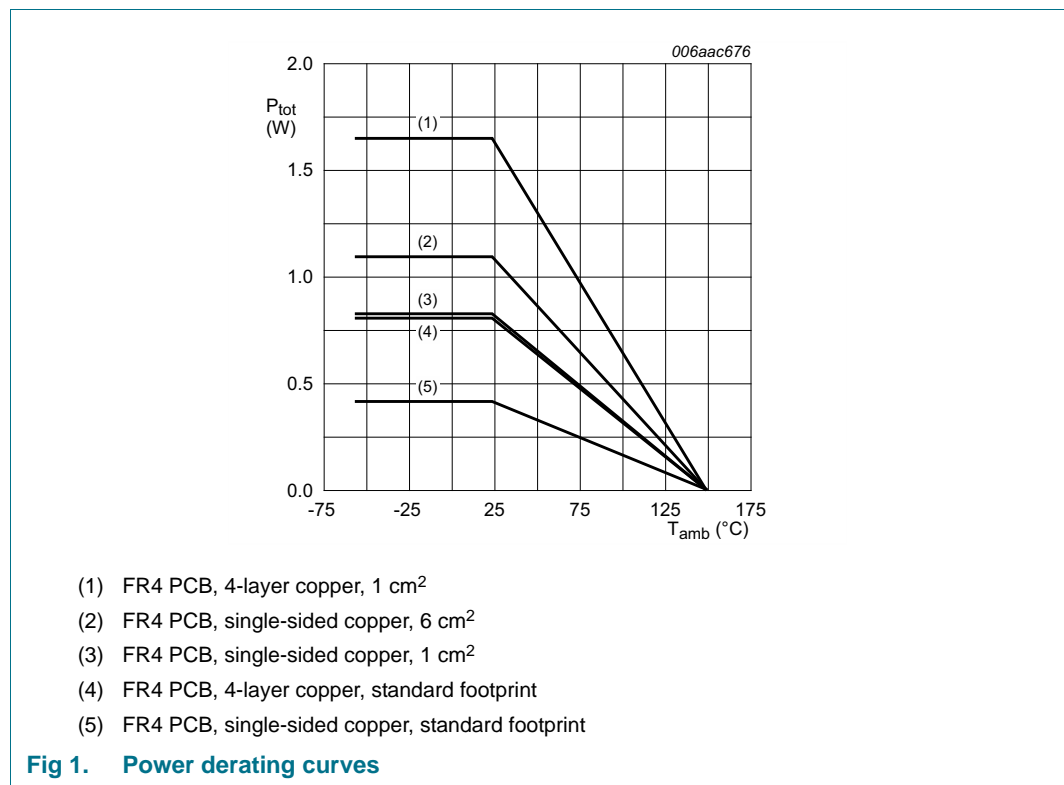
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	-32	V
$V_{CEO}$	collector-emitter voltage	open base	-	-20	V
$V_{EBO}$	emitter-base voltage	open collector	-	-5	V
$I_C$	collector current		-	-2	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-3	A
$I_B$	base current		-	-0.4	A

**Table 5. Limiting values ...continued**  
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	420	mW
			[2]	-	830	mW
			[3]	-	1.1	W
			[4]	-	810	mW
			[5]	-	1.65	W
T <sub>j</sub>	junction temperature		-	150	°C	
T <sub>amb</sub>	ambient temperature		-55	150	°C	
T <sub>stg</sub>	storage temperature		-65	150	°C	

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.

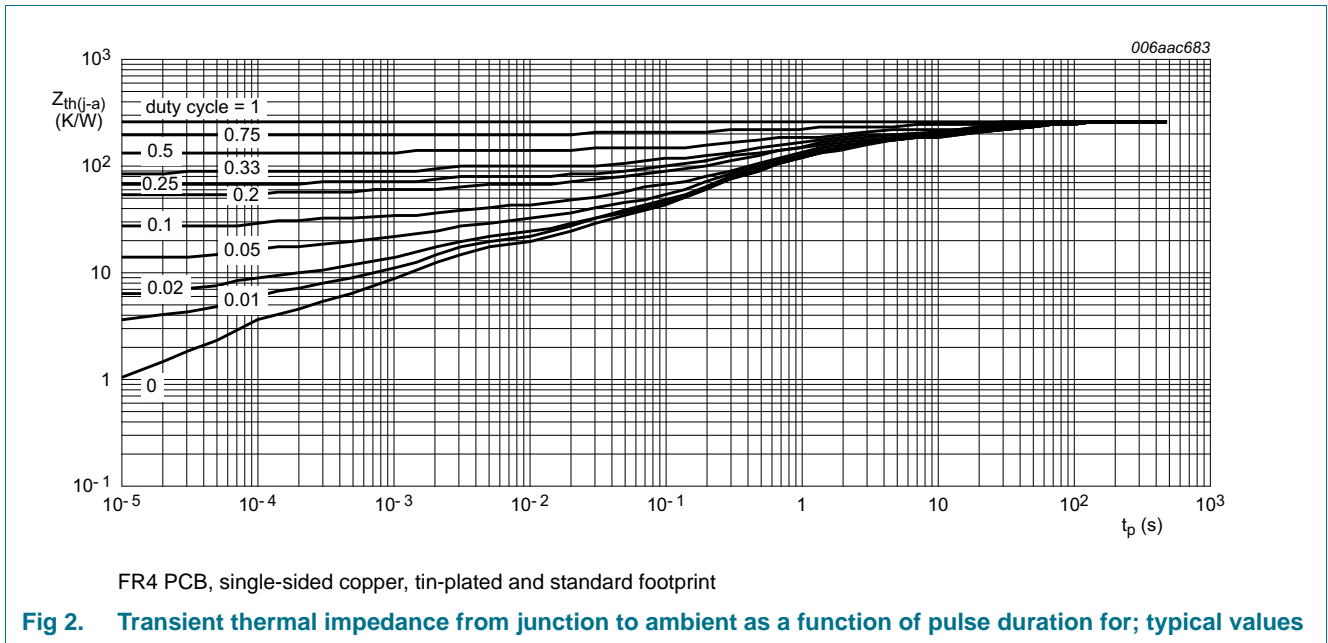


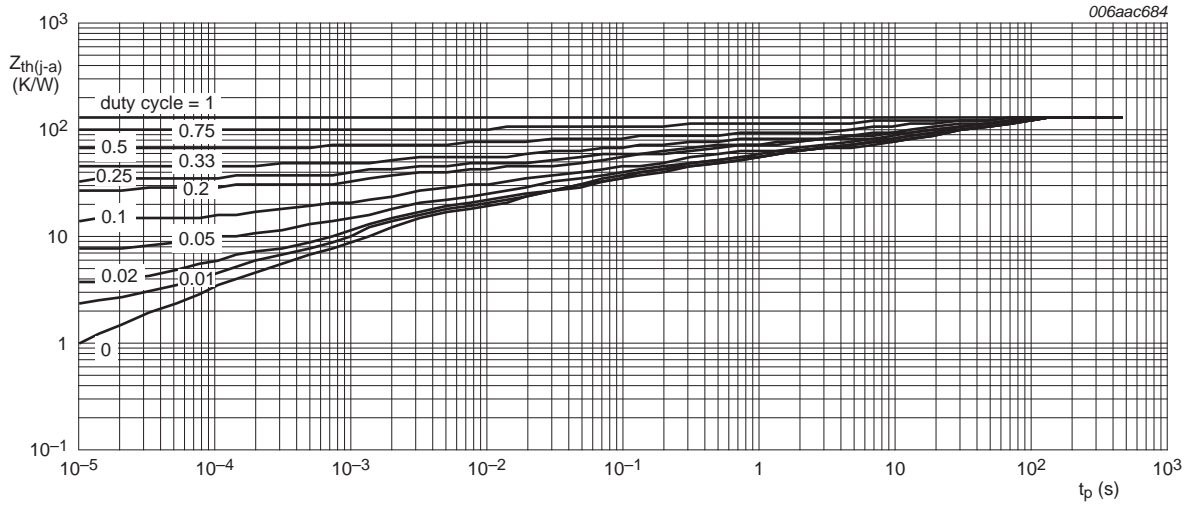
**6. Thermal characteristics**

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] 298	K/W
			[2] 151	K/W
			[3] 114	K/W
			[4] 154	K/W
			[5] 76	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point	in free air	20	K/W

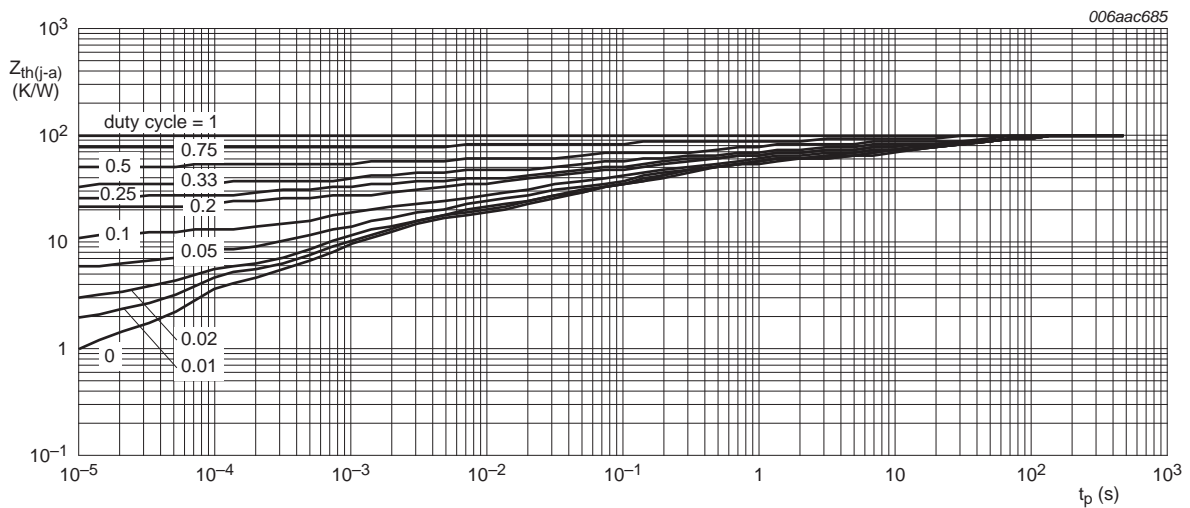
- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.





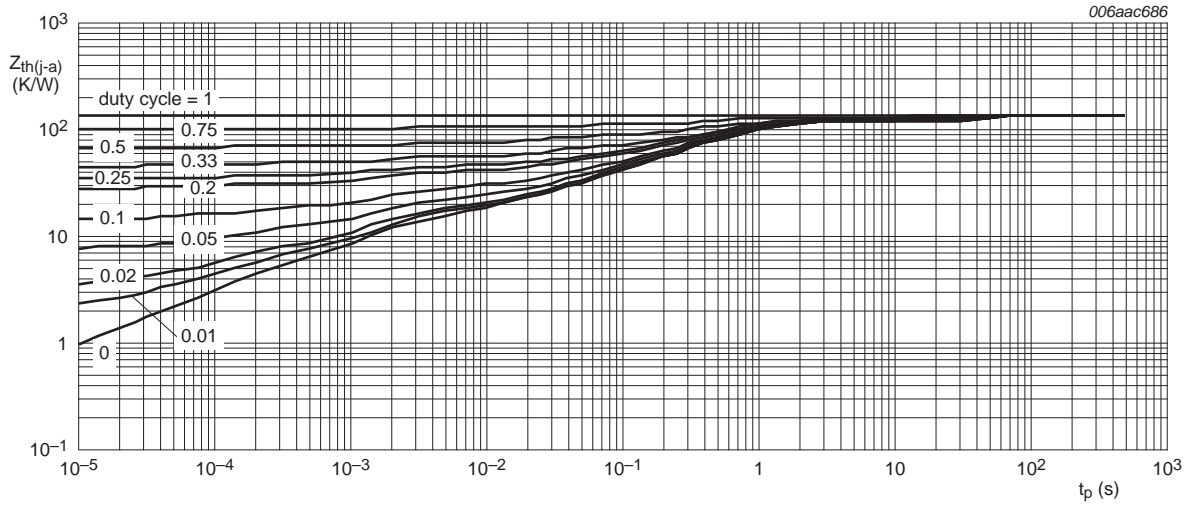
FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for; typical values**



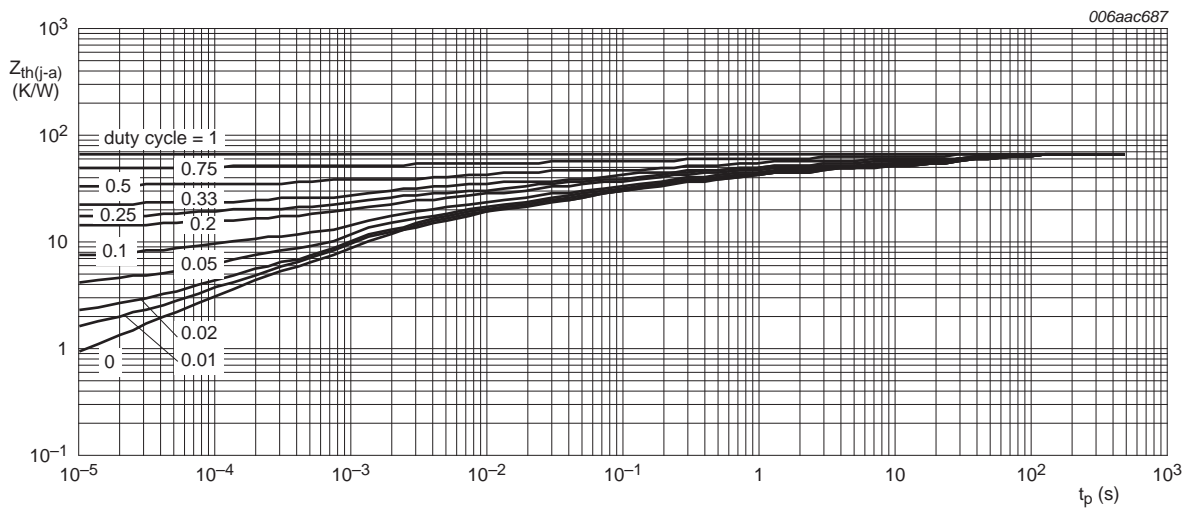
FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>

**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for; typical values**



FR4 PCB, 4-layer copper, tin-plated and standard footprint

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for; typical values



FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>

Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration for; typical values

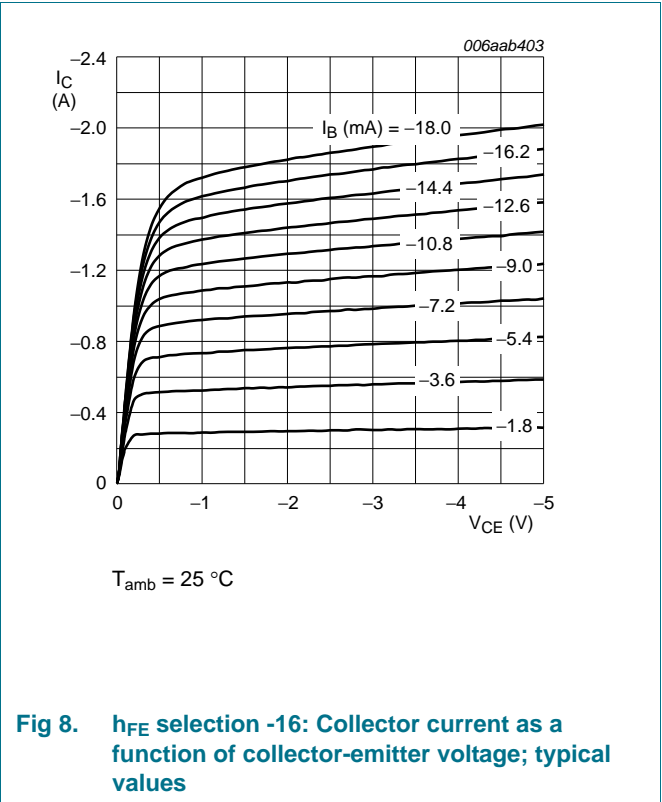
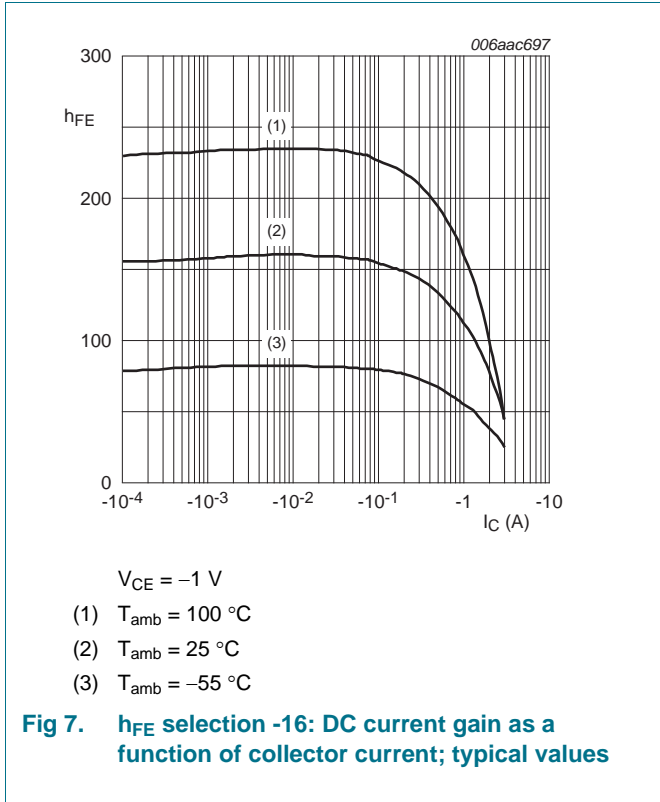
**7. Characteristics**

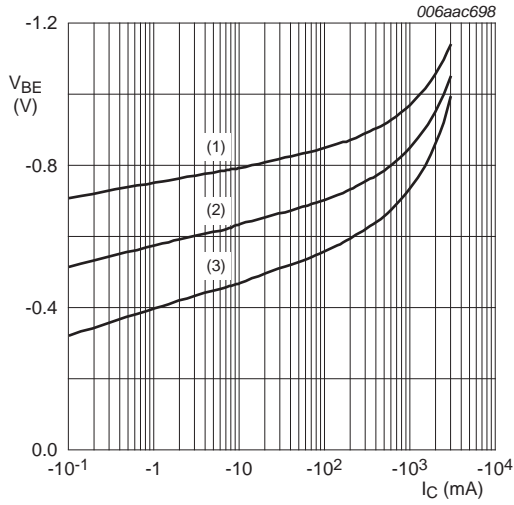
**Table 7. Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -25\text{ V}; I_E = 0\text{ A}$	-	-	-100	nA
		$V_{CB} = -25\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	-10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V}; I_C = -5\text{ mA}$	50	-	-	
		$V_{CE} = -1\text{ V}; I_C = -500\text{ mA}$	[1]	85	-	375
		$V_{CE} = -1\text{ V}; I_C = -1\text{ A}$	[1]	60	-	-
		$V_{CE} = -1\text{ V}; I_C = -2\text{ A}$	[1]	40	-	-
	$h_{FE}$ selection-16	$V_{CE} = -1\text{ V}; I_C = -500\text{ mA}$	[1]	100	-	250
$h_{FE}$ selection-25	$V_{CE} = -1\text{ V}; I_C = -500\text{ mA}$	[1]	160	-	375	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -100\text{ mA}$	[1]	-	-0.5	V
		$I_C = -2\text{ A}; I_B = -200\text{ mA}$	[1]	-	-0.6	V
$V_{BE}$	base-emitter voltage	$I_C = -5\text{ mA}; V_{CE} = -10\text{ V}$	[1]	-	-0.7	V
		$I_C = -1\text{ A}; V_{CE} = -1\text{ V}$	[1]	-	-1	V
$f_T$	transition frequency	$V_{CE} = -5\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$	40	140	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$	-	28	-	pF

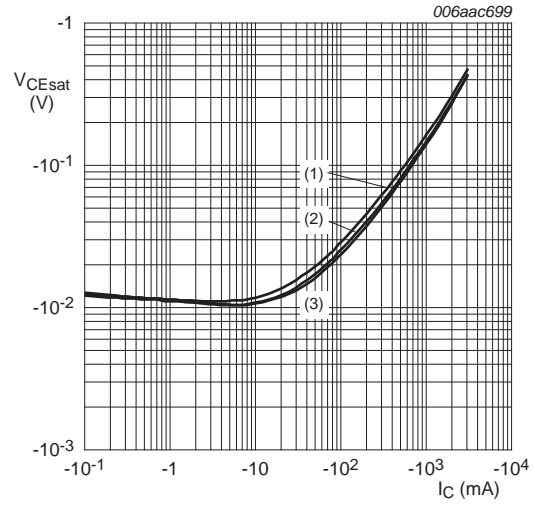
[1] Pulse test:  $t_p \leq 300\text{ ms}; \delta \leq 0.02$





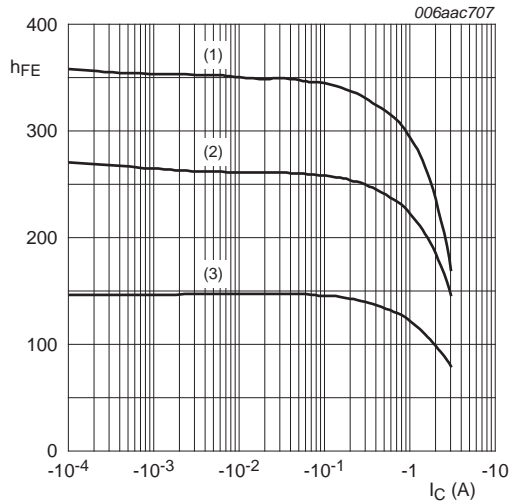
$V_{CE} = -1 \text{ V}$   
 (1)  $T_{amb} = -55 \text{ °C}$   
 (2)  $T_{amb} = 25 \text{ °C}$   
 (3)  $T_{amb} = 100 \text{ °C}$

**Fig 9.  $h_{FE}$  selection -16: Base-emitter voltage as a function of collector current; typical values**



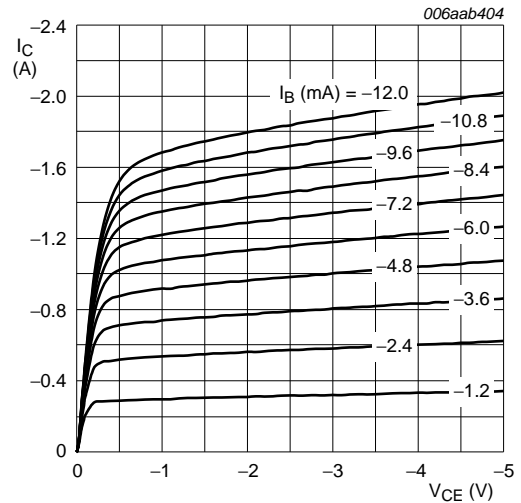
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100 \text{ °C}$   
 (2)  $T_{amb} = 25 \text{ °C}$   
 (3)  $T_{amb} = -55 \text{ °C}$

**Fig 10.  $h_{FE}$  selection -16: Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = -1 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ °C}$   
 (2)  $T_{amb} = 25 \text{ °C}$   
 (3)  $T_{amb} = -55 \text{ °C}$

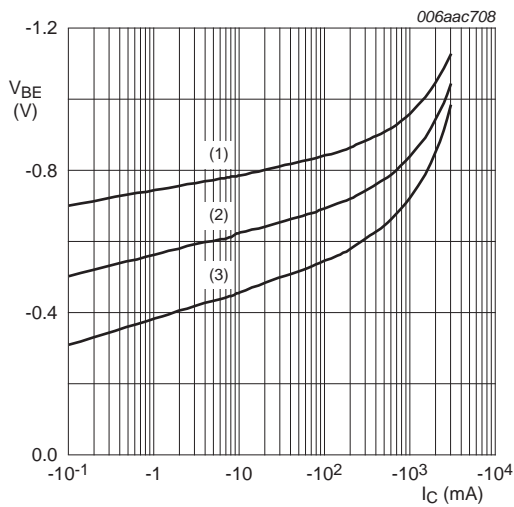
**Fig 11.  $h_{FE}$  selection -25: DC current gain as a function of collector current; typical values**



$T_{amb} = 25 \text{ °C}$

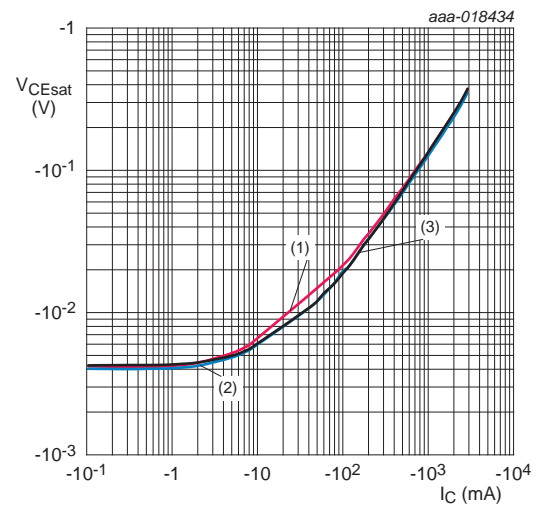
**Fig 12.  $h_{FE}$  selection -25: Collector current as a function of collector-emitter voltage; typical values**





$V_{CE} = -1 \text{ V}$   
 (1)  $T_{amb} = -55 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig 13.  $h_{FE}$  selection -25: Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 10$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

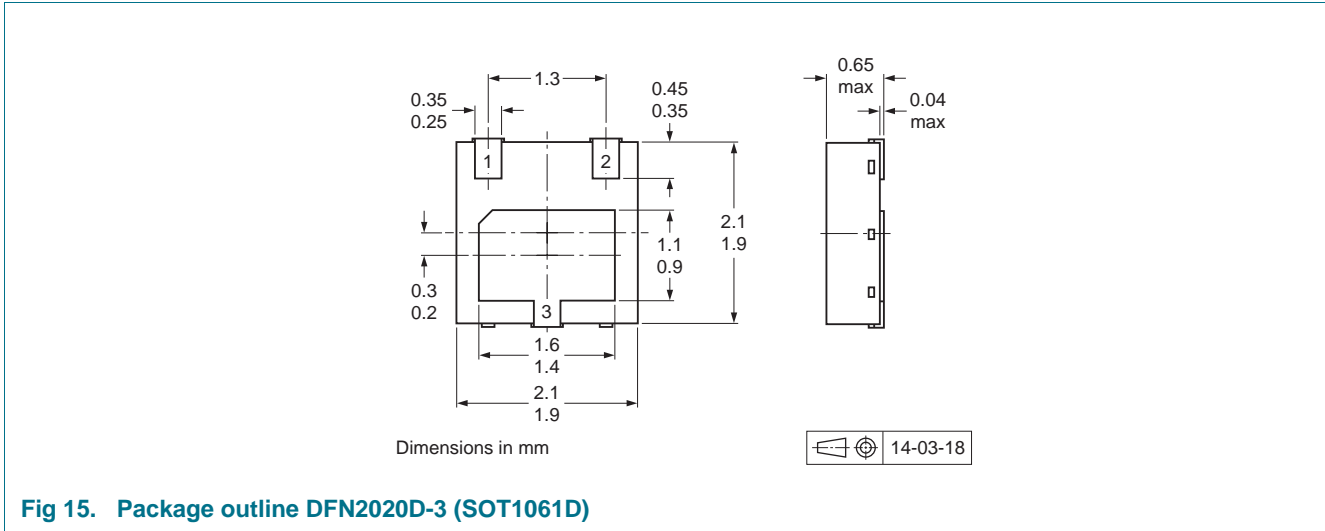
**Fig 14.  $h_{FE}$  selection -25: Collector-emitter saturation voltage as a function of collector current; typical values**

## 8. Test information

### 8.1 Quality information

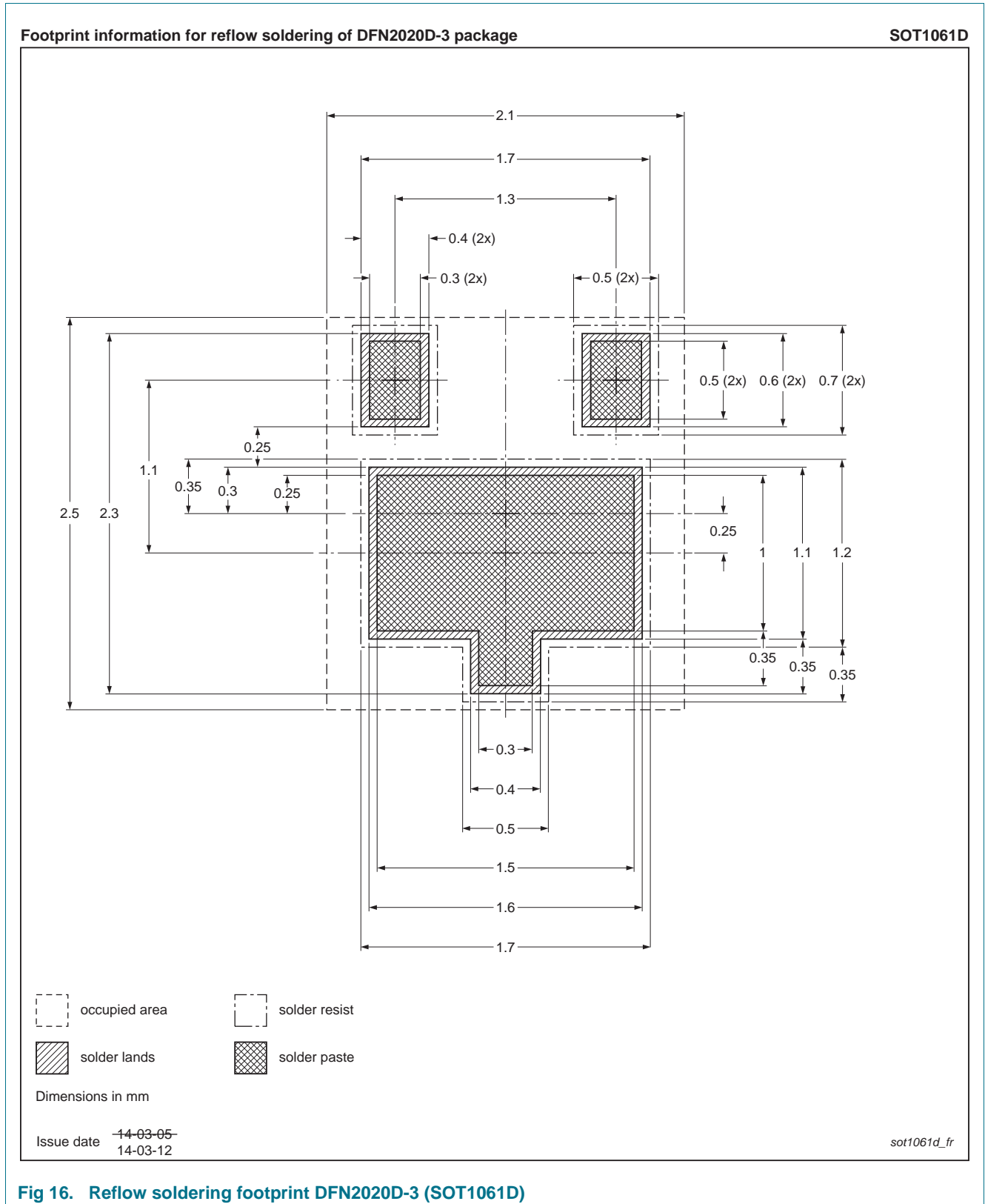
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

**9. Package outline**



**Fig 15. Package outline DFN2020D-3 (SOT1061D)**

**10. Soldering**



**Fig 16. Reflow soldering footprint DFN2020D-3 (SOT1061D)**

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC69PAS_SER v.1	20150619	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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Date of release: 19 June 2015  
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